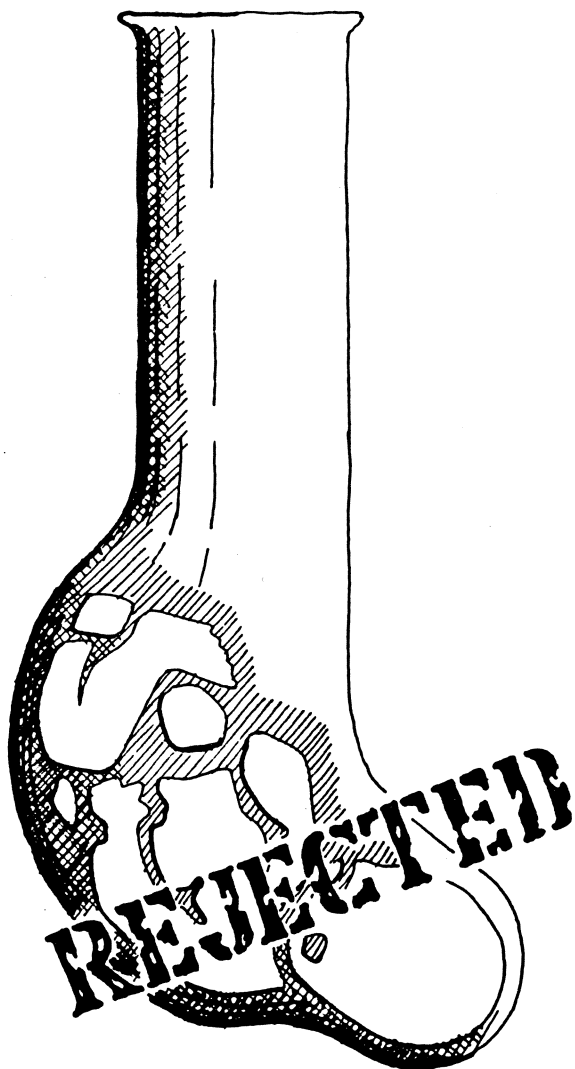


CREATION AND THE CHRISTIAN RESPONSE TO WARNOCK



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CONTENTS

- | | |
|--|----|
| 1. IMAGE IN EMBRYO | 3 |
| The Biblical Creation Lecture for 1985 | |
| N. M. de S. Cameron MA, BD, PhD. | |
| Warden of Rutherford House, Edinburgh. | |
| 2. GENETIC ENGINEERING: MONSTER OR MIRACLE? | 13 |
| Chris Darnbrough MA, PhD. | |
| Research Fellow, | |
| Department of Biochemistry, University of Glasgow. | |
| 3. DOCTORS AND WARNOCK | 31 |
| Pamela Sims, FRCS, MRCOG. | |
| Consultant Obstetrician and Gynaecologist, Hexham. | |

IMAGE IN EMBRYO

N. M. de S. Cameron

On the face of it, the question of the nature of the human embryo is an unlikely focus of public controversy, or even of controversy within the Christian church. We have, perhaps, a tendency to dispute about angels and needles, or about things which look like angels and needles to the man outside. And, of course, such disputes can be important, and necessary, though they are not always so. They can have their part to play in the theological and apologetic task of the church. Had the question before us today been raised twenty, or even ten, years back, it would have looked to all the world like one of those questions. Who could have foreseen that not only would embryos engage church assemblies in vigorous debate, but parliament would find itself presented with a petition bigger than any since the Chartists, and rocked by unprecedented controversy over Private Members' legislation.

There are, of course, plenty of people who still contend that this is much ado about nothing, that the millions who signed the petitions and the hundreds of MPs who supported the Unborn Children (Protection) Bill are deeply ignorant of the facts, moral as well as scientific; that public concern has been whipped up for no good reason, and that the Warnock compromise is the way ahead. These people include most of the medical and scientific establishment, many church leaders (particularly, if I may say so, Anglicans, but others too), the Department of Health and Social Security (who have been the villain of many pieces, this one included), and, of course, Lady Warnock, who has managed to lend her name not only to her committee of enquiry but to a whole branch of medical science and moral difficulty and a way of dealing with it.

The response which needs to be made is essentially a simple one. It relates directly to the Warnock Report itself. The report really should be read by those who are interested in the debate to which it has given rise, if only because it has to be read to be believed. In choosing to appoint the then Mrs. Mary Warnock to the chair of the enquiry, the Government seemed to be doing what we would all have wished them to do; they seemed to be treating the question as essentially moral, since Mrs. Warnock was a distinguished moral philosopher. And yet the report itself is one long attempt to avoid getting bogged down (I don't think that phrase is used in Warnock, but that is the message) in moral-philosophical questions. So what, for anyone with a morally serious outlook, is the most crucial issue in the entire debate — the question of the nature and status of the human embryo — is deliberately and decisively side-stepped by the report.

Lest it be thought that this is a prejudicial reading of Warnock, let me quote from the chapter in which the committee finally get down to the question of the nature of the embryo, after spending ten chapters discussing the techniques for the relief of infertility. This chapter is, interestingly, entitled 'Scientific Issues'. After referring to the question of the 'moral rights of the embryo' and the fact that it is an issue in dispute, the report goes on:

Although the questions of when life or personhood begin appear to be questions of fact susceptible of straightforward answers, we hold that the answers to such questions in fact are complex amalgams of factual and moral judgements. Instead of trying to answer these questions directly we have therefore gone straight to the question of *how it is right to treat the human embryo*.¹

This is a clever piece of writing, because in the guise of a simple admission of the complexity of the issues at stake, and of the need for a practical way of resolving them, it abandons the path of serious moral analysis in favour of that of pragmatism. No doubt some people do think that the questions to which this statement refers are actually capable of 'straightforward answers', in the sense of answers which do not involve 'complex amalgams of factual and moral judgements'. But this is not an adequate way of describing (and dismissing) those who hold that there are clear moral imperatives in this area. Being 'straightforward' is not the same as being simplistic, and anyone who has wrestled with philosophical writing on these questions will know that those writers who come to the straightest conclusions can get there by the most sophisticated means.

By declaring that they will not address the question of the nature of the embryo 'directly', Warnock implicitly accept the view that *the nature of the embryo is not the crucial question at issue*. I would want to argue that this is quite the most significant of all the conclusions of the committee, and yet it is given to us in the form of an *obiter dictum* for which no argument is offered. The reason for this is simple. It is hard to avoid the conclusion that, not merely from a Christian standpoint but from that of any serious moral interest, what something is considered to *be* is fundamentally significant for how it is to be treated. So the decision which the Warnock Committee took not to examine arguments about the nature of the embryo can reasonably be held to invalidate, at a stroke, a great many of their conclusions.

Warnock's Evolutional Background

The greatest of all the achievements of the history of organic evolution has been to break down the distinction between man and the beasts. It is, of course, more than

a little ironic that the assertion of the essential continuity of man with the rest of the created order is also the greatest of all the *assumptions* of evolution, and one which Darwin himself long hesitated to make. But as things stand, justified or not, the legacy of the theory has been to set any belief in the distinctiveness of man on the defensive.

Like so many theories which have sought to provide alternative understandings of man, and yet which, if taken to their logical conclusions, would prove seriously destructive of values which even those who propagate them wish to preserve, this particular legacy has been left largely untouched. But drawings are becoming more frequent, and in the face of the major new questions with which developments in reproductive biology have confronted us, the continuity of man and the animals has become of fundamental moral relevance. There is an extreme and important example of this to which I should like to draw to your attention.

One of the major contributors to international debate on what we are coming to know as 'Warnock issues' is Professor Peter Singer, of the Department of Philosophy at Monash University in Australia. The Queen Victoria Medical Centre in Melbourne, connected with the University, has made many headlines for its pioneering work in the field of reproductive technology, and a number of important publications have issued from biologists, philosophers and others associated with Monash.

Professor Singer has developed evolutionary reductionism in what seems to me to be a quite new direction. As well as contributing to debate on the ethics of embryo research and related questions, Professor Singer has published a book on 'animal liberation'. And he has coined a new term, which seems to me to focus our thinking in this area with some clarity. He uses it in response to arguments against abortion and embryo research which assert that the embryo is a human being and therefore to be respected 'like all human beings'. Writing with a colleague in the recent Monash symposium *Test-Tube Babies* he remarks:

When opponents of abortion say that the embryo is a living human being from conception onwards, all they can possibly mean is that the embryo is a living member of the species *homo sapiens*. That is all that can be established as a scientific fact. But is this also the sense in which every 'human being' has a right to life? We think not. To claim that every human being has a right to life solely because it is biologically a member of the species *homo sapiens* is to make species membership the basis of rights. This is as indefensible as making race membership the basis of rights. It is the form of prejudice one of us has elsewhere referred to as 'speciesism', a prejudice in favour of members of one's

own species, simply because they are members of one's own species. The logic of this prejudice runs parallel to the logic of the racist who is prejudiced in favour of members of his race simply because they are members of his race.

And he continues:

If we are to attribute rights on morally defensible grounds, we must base them on some morally relevant characteristic of the beings to whom we attribute rights. Examples of such morally relevant characteristics would be consciousness, autonomy, rationality, and so on, but not race or species.

Hence, although it may be possible to claim with strict literal accuracy that a human life exists from conception, it is not possible to claim that a human life exists from conception in the sense of a being which possesses, even at the most minimal level, the capacities distinctive of most human beings. Yet it is on the possession of these capacities that the attribution of a right to life, or of any other special moral status, must be based.²

I quote these passages for three reasons, first because they are extraordinary examples of moral reasoning (or, rather, of moral assertion), secondly because Professor Singer and his colleague succeed in admitting the very thing against which they seem to be striving to argue, and thirdly because in their use of this strange concept of 'speciesism' (which, I am glad to say, does not seem to have caught on) they indicate the appropriateness of this subject for a Biblical Creation Lecture. Let me take up these last two points in reverse order.

The charge of 'speciesism' is the most precise contradiction of the Christian doctrine of the creation of man as could be devised. It is the culmination to many centuries of whittling this doctrine away. It has various possible uses in current debate, and I hope that Christian apologists will press this deeply pagan idea into service in illustration of the illogic of the current obsession with 'human rights' — human rights conceived as natural rights as over against the human dignity which Christians have always believed to be conferred on man by virtue of his creation in the image of God. Professor Singer's approach to moral reasoning takes us a stage further away from the dignity *as man* we have his abilities, or lack of them, as 'morally relevant characteristics', in Professor Singer's vocabulary.

But we should not conclude that this kind of defence of embryo experimentation is limited to people like Professor Singer. His contribution has been to flush out the essential presupposition of their argument, and we are right to consider it to be deeply embedded in an evolutionary world-view. The specialness of every man must be justified, since he is an animal like any other. The fact that the human

embryo is a member of the human species is not simply irrelevant, it is worse (speciesism is immoral). On the other hand, it is quite relevant to point out, as Professor Singer and his colleague do on the next page of their essay, that the early embryo is 'far inferior to a tadpole in respect of all characteristics that could be regarded as morally relevant'.

We can now turn back to our second remark, noting that Singer finds himself in the position of admitting what we can, for present purposes, refer to as 'our side of the case' with a candour which is possible only because of the confidence with which he can then seek to avoid the implications of his admission — with his denial of any working concept of human dignity and human rights, and his flat assertion that the seeking of 'morally relevant characteristics' is the only way in which to determine moral worth. He has gone so far as to acknowledge that human life does indeed begin at conception. It can be established, we read, as a 'scientific fact', that 'the embryo is a living member of the species *homo sapiens*'. Of course, this may seem little enough. How could it be denied, that the fusion of sperm and ovum in this species, as in every other, brings into being the offspring of the parents? Yet it takes us directly into the subject of the nature of the embryo — you could say, indeed, that it takes us right through that question — which Warnock studiously managed to avoid touching. Singer can speak rather glibly of 'two possible senses of the term "human being"', but in seeking this way out he reveals the weakness of his position.

The Question of Potentiality

Before we go further it is as well to comment on the confused and confusing use of the idea of 'potential' as qualifying the human life of the embryo. No-one would wish to deny that there is much that is 'potential' in the embryo, as there is also, of course, much that is 'potential' in the new-born child. Indeed, there are many parallels between the two, for while certain features which are characteristic of human life are attained during the infant's development *in utero*, others do not appear until the first months, or in some cases years, of the child's life; and it is only after adolescence that it makes sense to speak of the human being as having fully developed into what it was intended to become. Even then the story is by no means told.

What, then, is the relevance of talk of 'potentiality' in the embryo? Does this category succeed in seriously qualifying the conclusions which we might wish to draw from the fact that the embryo is already a 'human being'? Professor Singer certainly thinks so, and it is worth our continuing with his presentation for a little longer.

Having spoken of the inferiority of the embryo to the tadpole as a possessor of

‘morally relevant characteristics’, Professor Singer asks ‘what of its potential? Unlike a tadpole’, he continues, perceptively, ‘it has the potential to develop into a normal human being, with a high degree of rationality, self-consciousness, autonomy, and so on. Can this potential justify the belief that the embryo is entitled to a special moral status?’

In denying the moral significance of the embryo’s potentiality Professor Singer adopts a parallel which has been commonly taken up in this discussion. He writes as follows, employing an argument which is patently false:

Everything that can be said about the potential of the embryo can also be said about the potential of the egg and the sperm. The egg and the sperm, if united, also have the potential to develop into a normal human being On the basis of our premise that the egg and the sperm separately have no special moral status, it seems impossible to use the potential of the embryo as a ground for giving it special moral status.³

It is no doubt true that a sperm and an egg are ‘potentially’ a human being (by which Singer seems to mean a born or adult human person), and it is also true that an embryo is ‘potentially’ that too. But the idea of ‘potential’ which is employed in these two cases is very different indeed. In one case (the separate sperm and egg) what we have is potentially something else altogether; in the other it is potentially merely the progression of its self. This point has been made with great clarity by Professor Thomas F. Torrance, who must rank as one of the world’s leading thinkers on the interface of scientific and religious thought and whose comment on the Warnock Report was that it gave him a ‘fierce jolt’ and ‘outraged’ his conscience ‘at a deeper level than almost anything else’ he had read in recent years.

Professor Torrance, in his useful pamphlet entitled *Test-Tube Babies*, argues that
If we want to think of the human embryo as ‘potentially person’, that must be taken to mean, not that the embryo is in the process of becoming something else, but rather that the embryo continues to become what he or she already is⁴

That is to say, whereas sperm and ovum must become something else if they are to develop into an adult human being, the fertilised embryo must simply become itself, fulfilling the destiny which in its own nature it has already come to possess.

We do not have space here to continue this particular discussion, but suffice it to say that in the cleavage between two entirely distinct notions of that ‘potentiality’ can be taken to imply there lies the answer to glib attempts to place the fertilised embryo on the same moral footing as its constituent elements prior to their union.

The Significance of the Divine Image

With this consideration of what the embryo is in itself we are brought to the question of what it is in relation to God. Granted that the biological evidence would lead us to conclude that the human embryo, like every embryo, is a tiny member of the species of its parents, do we have a distinct moral construction to place on this conclusion? Professor Singer's dismissal of it stems from his own concept of what matters about man, where man's moral significance lies, what (to use his terms) are 'morally relevant characteristics'. For him, membership of the species is not relevant; and claims that it is are sheer prejudice.

The Biblical doctrine of man sets Singer's 'speciesism' nearly upon its head — nearly, because Scripture agrees that man is not to be absolutised. It is not *merely* because a man is a member of my species, nor that that happens to be *Homo sapiens*, that I must afford him special rights and dignities. The ground of man's dignity lies neither in his being *Homo sapiens* nor in his being of the same species as me. Rather, it is because his particular form of being (man rather than gorilla, man rather than tadpole, man rather than tree) reflects and derives from God in a way in which none other does or ever could, that every man demands respect, from me and from every other creature.

With these qualifications, the Christian's rejection of Singer's attempted morality can be complete. The reflection of and derivation from the divine are irrevocably bound to mankind. They are, as has been said, *species-specific*. It is difficult to see how any other exegesis of Genesis is possible, since Genesis 1, whatever else it is, provides a taxonomy of the created order. However we construe the scope of its biological categories, it is evident that the category 'man' is co-terminous with what *we* mean by man. It refers to *Homo sapiens* as such, and is not concerned to distinguish between some members of the species and others, whether on the basis of the presence and absence of particular qualities (rationality, the ability to communicate, or any of the possibilities which Professor Singer regards as 'morally relevant') or age or anything else. What is made in the image of God is *man*, nothing more, nothing less. What is meant by 'man' is then a question for the biologist, not the exegete or the ethicist.

We need at this point to make some answer to the charge that, having elsewhere sought to make Scripture teach geology or biology, we are here seeking to make it teach embryology and fetology. It seems to me that we are doing nothing of the sort. The Bible is not an embryological textbook, and, paradoxically, the only people who think it is are those who take issue with the evidential validity of the kind of Biblical material which we have been citing. What they say is that they seek more specific, plainer, statements; they look for references to the essential nature

of the unborn child, to the actual point at which the developing embryo/foetus becomes or is given a soul. They are, of course, asking for the moon. Insofar as they are sincere in saying that this is what they seek (that is a section in Young's *Concordance* and, presumably, in Berkhof's *Systematic Theology*, under 'embryology') they are making exactly the mistake of which they so readily accuse us. They are casting Holy Scripture in a role which it was never intended to play. The fact that it does not make definitional statements of this kind simply does not carry the implication that it has nothing to say on these subjects. By making the use, which we do in this case, of the Biblical concept of man *qua* man as the bearer of the *imago dei*, and drawing out the implications of this concept for embryology, it is we who are playing by the rules. This is exactly how Scripture should be brought to bear upon such questions. The difficulty is that some approaches to this subject have been so deeply affected by philosophical notions of an altogether different kind (particularly the idea that to be a person in the sense that you have any moral worth you have to be rational and self-conscious, and so on) that the sort of biblical-theological argument we are advancing is doomed to fail. Those whose minds have already been influenced another way have no option but to demand: 'find me a text which states: from day one every embryo, whether *in vivo* or *in vitro*, is a person made in the image of God, destined for eternity, and able to make all the moral claims on us of every other person. If you can't, if all you can produce are sophisticated arguments of theological inference, then I'm going to carry on thinking and doing as I please.' Such a characterisation will, of course, seem unfair to those whom it seeks to characterise and who believe, like the rest of us, that their arguments stand on their own feet. In the face of the kind of case which has been made against them, both Biblically and — especially by the Catholics — on natural moral principles, it seems to me to be unavoidable that we should construe their reaction to it in some such terms as these.

I say that partly because of the following consideration, which takes the argument from the ontology of the embryo a stage further.

The Significance of the Incarnation

Alongside the general argument from the *imago dei* there stands a specific argument from the case of Jesus Christ. The Bible contains many accounts of ante-natal life, particularly in the Old Testament, where it is almost required that writers should reflect on their life before birth. Some of these references are more valuable than others, in that in certain contexts the chief interest of the writer is in the divine foreknowledge. If the reference goes back before conception, as some do, it is more difficult to regard it as relevant to the ontology of the product of conception, since there can, of course, be no question of its pre-existence.

Some of the texts often referred to are of more help. But of each of these cases it

has been suggested that the fact that a writer reflects on his origins in the womb need not have ontological implications. That is to say, the fact that Jeremiah harks back to his earliest days *in utero* does not of itself argue that *every* intra-uterine life should be accorded the dignities of personhood. It might, for example, be necessary for an embryo or foetus to pass a certain point before gaining a status which would bear retrospective implications. So embryos dying *in vitro*, and even foetuses succumbing to abortion, would remain as possible persons rather than actual, while you and I and Jeremiah, having been actualised (at 14 days, 3 months, 6 months, birth, or whenever) are able to look back at the early origins of ourselves before this time and still say that ‘that was I’.

This argument has a certain force, it seems to me, although not enough to do the job for which it has been constructed — to deflect the entire momentum of the Biblical witness to intra-uterine life, that is, the *specific* evidence which Scripture affords in illustration of the plain ontology of its statements about the divine image. Leaving to one side objections to the argument on its merits, it does not adequately meet the difficulties posed by some of the biblical texts (which seem to bear their own ontological implications). But it comes nowhere near relevance to the most important of them all. I hesitate to suggest that the argument from the incarnation has a knock-down significance in this debate, but many will feel this to be the case. I can understand why that brave defender of Warnock, the Archbishop of York, was heard to cry out in the midst of the recent debate in the Church of England’s General Synod, ‘I don’t want to hear anything more about the incarnation’. It seems to me that you have only to set this argument up to win it, which is presumably why Dr. Habgood did not wish to play.

According to the creed, the life-story of Jesus Christ upon earth began with his being conceived by Mary through the agency of the Holy Spirit. In asserting this the creed follows the Gospel testimony, in which Mary is told that she will conceive as a result of the Holy Spirit ‘coming upon’ her, and the ‘power of the Most High’ ‘overshadowing’ her. That is to say, the Gospel birth narrative fully accords with the common-sense reading of the biological evidence that the act of incarnation took place not at Bethlehem where the baby was born, but before ever the journey to Bethlehem began. God became incarnate in an embryo. There are several particular exegetical reasons for such a reading of the Lucan narrative (not least, the evidence of John the Baptist, filled with the Spirit *in utero*), but it is logically necessary to identify the incarnation with the virginal conception since there is no other point in the story at which it can have occurred.

The life-story of Jesus Christ, God and man, begins in the earliest days of his embryonic biological existence; and the significance of this fact is that the manhood which he took on is our manhood. That is, it cannot be claimed that his case was in this respect unusual, since the entire principle of the incarnation is the

taking up of normal, yet sinless, humanity by God. If that is the point at which his human life-line began, it is also the point at which ours begins. Such a conclusion immediately rules out any attempt to relativise the moral significance of the early stages of life.

It also ties in with the question of the divine image, which we have already discussed. For the reason why God could become man was that man, although his creature, already bore his image, reflecting the personal character of God in a human form. For God to become man in embryo therefore requires that man in embryo already bear the image, and absolutely forbids the possibility that in the early stages of his biological life man can lack the divine image because lacking something which is its pre-requisite. On the contrary, for God to become man by the miraculous fertilising of one of Mary's ova, it is necessary that a fertilised ovum should be image-bearing already and of its own nature. Man the biological entity and man the creature of God must be identical. The image, with all that it implies, must be species-specific; and any argument which seems to divide biological man from man the image-bearer is revealed as mere sophistry in attempted defence of an inherently indefensible proposition, namely (in Professor Singer's words) that there are 'two possible senses of the term "human being"', one with a reference to species membership only, the other with more implications.

The human embryo, as the earliest stage in the existence of the human being, already carries the rights and dignities which membership of this most special species entails. Biblical testimony walks hand in hand with biological fact, Man in embryo is man already, and any doubt is resolved by the evidence of Scripture that the supreme man, the man who was also God, began his human existence at this point too.

Notes

1. *Report of the Committee of Inquiry into Human Fertilisation and Embryology*, Cmnd. 9314, p.60.
2. Helga Kuhse and Peter Singer, 'The Moral Status of the Embryo', in *Test-Tube Babies*, ed. William Walters and Peter Singer, Melbourne, 1984, p. 60.
3. *Ibid.*, p.61.
4. Thomas F. Torrance, *Test-Tube Babies*, Edinburgh, 1984, p.11.

GENETIC ENGINEERING: MONSTER OR MIRACLE?

Chris Darnbrough

Monster?

The last ten years have seen a dramatic increase in our understanding of the mechanisms of heredity, and indeed of the whole of biology, at the molecular level. This has come about largely as a consequence of advances in molecular genetics made possible by the application of recombinant DNA technology, which is transforming the study of virtually every area of the biological sciences. Genetic engineering is perhaps an unfortunate label, conjuring popular images of genetically modified human beings leading to the production of clones of bionic men and women. It is important to realise that recombinant DNA technology — or DNA cloning — has been used as a powerful research tool for studying the structure and function of DNA, and has nothing to do with the cloning of whole organisms, animals or humans. However, the technology has advanced rapidly to the stage where it can now be applied in ways which potentially could change the human condition radically, for good or evil. Tragically, our Western culture is unprepared for the ethical implications.

It is certainly no coincidence that the ingathering of knowledge and the advance of DNA technology has proceeded alongside the rise of the evolution-centred modern scientific enterprise; indeed the two complement each other in promoting an extreme reductionist view of man. This would see each person as no more than the expression of a collection of genes or DNA sequences — a view which the vast majority of people would acknowledge to be incomplete, but which dominates the ethics of science, biology and even medicine, and sets forth a prospect of future progress which utterly discounts the unique status of man in the created order and his position before a holy God, the Creator. We must therefore affirm as of first importance, that human salvation and the hope of glory are to be found through faith in Christ alone. We must also recognise that man, though created a perfect being both spiritually and physically, is fallen and sinful, with effects manifest at the biological level in the degradative evolution of the living world, the results of which include defective genes and genetic disease in man.¹ It has always been the aim of medicine and health care to overcome these.

The purpose of this paper is to suggest ways in which we might develop a Biblical perspective on the application of recombinant DNA technology and genetic engineering to human embryology and medicine. In order to do this we must look

at the development of the technology, sometimes at a fairly technical level, over the past ten years.

This new methodology simply harnesses the biochemical components of the DNA-modifying processes present in bacteria. It has been known for many years that genetic material, DNA, consists of very large molecules made up of strings of chemical units called nucleotides, or bases. A typical human chromosome contains a single string of many millions of DNA bases, which in turn consists of thousands of functional units called genes, each gene being a sequence of several thousand bases. A gene essentially encodes a single protein molecule, along with all the regulatory functions of the gene which control the expression of the protein in response to signals such as hormone messengers and developmental switches. The previously insurmountable obstacle to the isolation of genes, and to the study of their structure, function and regulation, was the enormous size and complexity of DNA molecules.

The New Biology

The discovery of restriction enzymes, which in bacteria serve to prevent the entry of 'foreign' genetic material into the cell, provided a means of cutting the enormous DNA molecules into smaller, more manipulatable pieces, in a specific and reproducible way. These pieces can then be joined, or ligated together again using bacterial enzymes normally involved in the replication and repair of DNA. By recombining pieces of DNA from different organisms, specific regions of DNA, or genes, can be isolated, and cloned into the DNA of bacteria. Because bacteria replicate very rapidly, many copies of the cloned gene can be obtained, starting from a single bacterial cell containing a single copy of the gene. Apart from the opportunity to study gene structure and function, these techniques allowed the molecular geneticist to manipulate and propagate specific regions of the genetic material of higher organisms, as it were in the test tube, and raised the real possibility of modifying the genetic make-up of whole organisms, including man.

The term 'genetic engineering' was coined early in the development of this new technology, and its possible implications aroused concern among non-scientists, and considerable caution among scientists themselves. Indeed in 1974 a major conference at Asilomar in the USA, resulted in a self-imposed moratorium on all experiments involving recombinant DNA, until the implications were better understood. The scientists themselves were concerned that their experiments might inadvertently release modified and perhaps harmful genes into the living world, with totally unpredictable results. Their caution also arose from the fact that the only bacterium which was adequately studied at the genetic and biochemical

level to be useful as a host for cloning DNA, was the organism *Escherichia coli* (*E. coli*), a normal inhabitant of every human gut. There was thus a very real possibility of transferring foreign genetic material, and its products, neatly packaged into efficiently replicating microorganisms, into the guts, and perhaps ultimately the germ cells, of humans and other animals. Nobody really knew what might be the consequences of such experimentation.

Research in molecular genetics eventually started under conditions of strict containment. Recombinant DNA is contained at two levels, biological — which means that the host organisms are disabled by introducing deleterious mutations into their genomes — and physical — which requires the experiment to be carried out in laboratories designed to prevent the escape of recombinant organisms into either the experimenters or the environment. As work proceeded, the discoveries of recombinant DNA research itself soon began to reveal that the earlier fears of the scientists had been too pessimistic. The probability of any damage resulting from techniques themselves is in general very small, largely because of differences in the mechanisms of gene expression in bacteria and higher organisms which effectively prevent the transfer of genetic material from bacteria to man. While it remains true that the cloning of DNA sequences such as genes for bacterial toxins or cancer-causing viruses is very hazardous, for obvious reasons, recombinant DNA research itself has provided the grounds for a steady relaxation of the conditions under which it is carried out.

While the direct consequences of the activities of molecular geneticists beaver away in their laboratories have ceased to be of any real concern to those outside that somewhat exclusive group, the fruits of recombinant DNA research have produced exciting discoveries at the scientific level, and promise to have an even more dramatic impact on the whole of society in the realms of industrial and medical biotechnology. Many countries already possess thriving biotechnology industries, and the chemical and pharmaceutical companies are reaping the benefits of biotechnology in industrial microorganisms, insulin and growth hormone production, and many other areas. Recombinant DNA also offers opportunities to achieve advances in crop production and animal rearing which bypass the time and resource-consuming traditional methods of breeding and selection. Such progress is already being exploited, and few would question the potential benefits or the means of obtaining them. These applications of technology certainly appear to be within man's creation mandate to fill the earth and subdue it. Tragically, fallen man's inability to apprehend correctly his position within creation, and his failure to recognise the tarnished image of the Creator in himself, once again threaten to transform the blessing into a curse. The tree of knowledge ever yields up both good and evil.

Our understanding of the mechanisms of gene expression and of heredity is growing rapidly, and the genomes of higher animals are now seen to be highly mobile. Many 'normal' cellular mechanisms are able to rearrange and modify genes, some in highly specific ways in order to control gene expression, some at random. The existence of mechanisms within cells which cause random changes in the genetic material has 'exciting' implications for evolution, which it is not our purpose to discuss here. However, a corollary of this result is that the efforts of molecular geneticists, to isolate, modify and alter the expression of normal genes, merely mimic the processes which already are driving evolutionary change in all organisms, including humans. Evolutionary change, however, is random, whereas molecular genetics is able to bring about intelligent and purposeful change. It is easy to see the relentless scientific logic which transforms the popular image of genetic engineering as the monster of the 1970's into the miracle of the 1990's, when man will have taken control of the course of his own evolution, possessing the means to eliminate genetic defects, to determine the genetic characteristics of his descendants, and ensure his survival as a successful species on this planet.

This alone can be the one ultimate aim of human embryo research. Even research directed towards the relief of infertility — however desirable, and whatever our ethical viewpoint — is a step in that direction, and the scientific and medical lobbies are clamouring for resources and for licence to take at least that step, and in many cases to go further.² Lay people, and in particular MPs and legislators, appear remarkably ill-equipped to assess or to resist the demands of the scientists, and the instinctive, but often ill-informed revulsion towards embryo research is all too easily crushed by the powerful argument and tactics of its proponents, couched as it is in the language of (often genuine) compassion, and with the promise of hitherto unimagined benefits. All too often it is the case that scientific advance is motivated by the desire for knowledge, reputation and power rather than love of one's neighbour.

The fundamental problem is that a society which has rejected any universal (Biblical) ethical standards is now bereft of any means of establishing principles on which to base ethical decisions. In the case of embryo research, the majority know it to be wrong, but they don't know why it is wrong. The result is a society which, rather than being served by technology, is in danger of becoming subservient to the needs and aspirations of the scientific enterprise. There is no clearer illustration of this than the various criteria which are proposed in the attempts to define the starting point of human life. If this tyranny is to be avoided, it is essential now to assess the whole potential of genetic engineering, in the applied sense of modifying the human genome, and to formulate an ethical response to it with the aim of constraining future research by ethical principles. Although many

theoretical possibilities are technically out of reach at the present, we must be prepared for rapid progress; it is too late to mount an effective response to routine aspects of current practice. The science fiction of 1975 is biotechnology in 1985, and more reputations are being built on the fulfilment than on the fiction.

What, then, has been achieved, and where is it all leading us? As we look at the development of the problem it will become clear that we are not dealing with a single scientific discipline. The ability to apply recombinant DNA technology has developed hand in hand with improved manipulative skills, increased sensitivity and precision, and advances in medicine which have been heavily dependent on the application of physics, in radiation, nuclear and laser technologies in particular. The net result is that it is now possible, in practice, to introduce specific pieces of foreign DNA into a single celled mouse embryo, grow the foetus to term and subsequently to study the expression of that DNA in the full-grown mouse.³ Already, then, we are able to determine the effect on the mouse of making specific alterations to the genetic material of the fertilised egg. The same experiment could, today, be performed on a human embryo. Gene therapy in the mouse is already a routine research tool; human gene therapy is more than a possibility.

Prenatal Diagnosis

The 1960's and 70's saw the development of genetic counselling as a means of avoiding the birth of children with genetic defects. Such negative intervention, relying on understanding of the classical genetics of heritable diseases, allowed potential parents to choose whether or not to conceive children on the basis of the probability of transmission of a known genetic defect, such as haemophilia or cystic fibrosis. Essentially the only data available consisted of the family history of transmission of a disease, and especially in the case of X-chromosome linked disorders, where it was difficult to determine whether a woman would in fact be a carrier, there were considerable uncertainties. It was impossible to know whether a given pregnancy would result in the birth of an affected child until the development of various means of determining, for certain disorders, whether a given foetus carries a given defect. Hand in hand with the 1967 Abortion Act, such methods allowed a more positive approach. Prenatal diagnosis offered every fertile woman carrying a genetic disorder, or at high risk of a congenitally abnormal foetus, the opportunity to conceive first and later to decide whether to continue the pregnancy. Medical technology ensured that there need be no prospect of having to care for a disabled child as a result. Often, in practice, the decision for or against 'termination' in the case of a positive diagnosis, is more agonising for the mother than the decision whether or not to have children in the first place. The presence of a child in the womb is somehow different from the mere prospect! How many women regret that the test was ever offered to them? How many healthy foetuses may have been aborted on the strength of a false

positive? — even if it be allowed that the death of a defective foetus is preferable to a handicapped post-natal life. Nonetheless, in a technology-dominated culture, available technology must be totally available, and the pressure on each one of us to take advantage of all that is offered is considerable. As a result the prenatal diagnosis/termination option is now almost routine, and hard to resist. The detection of a defective foetus is akin to diagnosis of a disease state; abortion is the only treatment available and is more cost-effective than post-natal care. The ethical problems inherent in the approach, which would have constrained its development in the first place, are seen as unfortunate side-effects, which do not yield readily to technological solutions.

The possibility of prenatal diagnosis depended initially on the surgical technique of amniocentesis, which allows the recovery, at weeks 16-20, of sufficient amniotic fluid for biochemical analysis, and of foetal cells on which chromosome analysis can be performed. The simplest application is perhaps that of sex determination, not to allow foetal sex discrimination, but to assist in genetic counselling of sex-linked diseases. A haemophilia carrier, for instance, could now conceive a child, and if a sex determination indicated a female child, the pregnancy could be continued, while a male foetus became a candidate for termination. Certain other abnormalities, such as Down's Syndrome (not an inherited disease) are associated with gross chromosomal defects which can be easily diagnosed in amniotic cells. Biochemical analysis of the amniotic fluid is also able to indicate many congenital abnormalities and inherited disorders in the foetus. Non-invasive techniques, such as ultrasound and X-rays, are also diagnostically useful.

At this point a distinction should be made between genetically inherited (Mendelian) disorders, and congenital abnormalities which appear during the growth of the foetus. Conditions involving loss, duplication or translocations of chromosomes (such as Down's Syndrome) have no direct genetic cause, but arise from errors in chromosome replication very early in development. They can, however, be detected from the earliest stages. Also in this second category are neural tube defects (such as spina bifida), which result from failure to complete certain stages of the anatomical development of the foetus. Most such disorders can be detected, by chromosome analysis at any stage from which foetal cells can be obtained, or by biochemical methods or immunoassay of specific proteins in amniotic fluid. Because prenatal analysis at an early stage is unable to predict the postnatal severity of the condition with any certainty, the decision for or against abortion, or for testing or not in the first place, is particularly difficult. In the case of the 200 or so recognised genetic, or Mendelian (i.e. inherited according to the laws of classical Mendelian genetics) disorders about 150 give rise to a known

abnormal or defective protein product which can be assayed in culture cells from amniotic fluid. In other cases, the protein product is expressed in the foetus, and is now accessible via fetoscopy (e.g. phenylketonuria). In others, no protein defect has yet been discovered (e.g. cystic fibrosis, Duchenne muscular dystrophy), although indirect biochemical methods may sometimes be available. All such biochemical immunoassay methods of diagnosing defects, genetic or otherwise, possess an inherent degree of uncertainty, related to the accuracy of the measurements themselves, and to the problem of defining the 'normal' level of a given biochemical component. In every case diagnosed by such means, there arises the possibility of aborting a healthy, probably loved and wanted, foetus.

The view that earlier abortion is safer, medically, psychologically and ethically, has driven the development of earlier, more sensitive and more reliable methods for the detection of foetal abnormality. Amniocentesis is not practicable before the 16th-20th week of pregnancy, at which stage 'termination' is recognised to be 'traumatic'. Newer surgical techniques now allow sampling of foetal material much earlier. Chorion biopsy, by means of a catheter inserted through the vagina, samples a small piece of chorion tissue, which although not a part of the foetus itself, contains the foetal genes. Fetoscopy, even more sensitive, but involving somewhat greater risk, allows a small biopsy to be taken of specific foetal tissues, such as skin, liver or blood. Recombinant DNA technology facilitates the analysis of tiny amounts of material thus made available. Like other methods of analysis, recombinant DNA techniques are ultimately limited by the amount of material available, but sufficient foetal DNA can be obtained by culturing *in vitro* the small amounts of foetal tissue obtained by chorion biopsy or fetoscopy. In such culture the genes in question are replicated faithfully, but there is no certainty that the biochemical characteristics of the cells will be faithfully maintained.

Genetic Analysis

Recombinant DNA offers a diagnostic tool which, in principle and increasingly in practice, is free of the uncertainties of biochemical methods. The potential accuracy of the molecular genetic approach lies in its 'digital' nature. Unlike 'analogue' biochemical measurements, which are limited by experimental accuracy, are subject to natural variation and require subjective interpretation, genetic data are precise and digital. A sequence of bases in DNA is definitive; a given base is at a given position or it is not; a gene is present or it is not; a mutation is present or it is not; a particular single base change in a human haemoglobin gene will, if homozygous (present on both chromosome copies), result in an individual with sickle cell anaemia; if heterozygous (present only on one copy), will result in a carrier of the sickle cell trait, and will also confer resistance to malaria. Such correlations are exact, providing in principle the error-free diagnosis

in utero, of sickle cell anaemia, haemophilia, phenylketonuria, cystic fibrosis, and hundreds of other genetic diseases. In principle, it will be possible, in the lifetime of many of us, to provide a pregnant woman with a catalogue of defective genes carried by her growing foetal infant, and of the genetic diseases from which the child will suffer. These could include an estimate of the probability that the child will at some point develop, for instance, diabetes. The same analysis is applicable also to the egg or sperm cells of adults, which would facilitate genetic counselling, but of course does not define the genetic status of a given foetus. It is also the case that many 'inherited' diseases can arise spontaneously as the result of mutations appearing in the progeny of genetically normal parents.

Often no direct probe exists for the defective gene and in practice it is possible to identify defective genes only by means of their genetic linkage to a different region of the DNA which can be detected by current methods (restriction mapping). The linkage can be broken by recombination between the parental chromosomes and the diagnosis also requires analysis of the parental genes. Currently the resultant error is around 5% for most probes, with the consequent risk of false positives, but testing kits for many genes will soon be commercially available.⁴ Improved technology will reduce this error, if necessary to zero by sequencing the entire gene in question.

Search and Destroy?

What is the value of such knowledge? Do the data have any value even if an incurable disease is indicated? If the only intervention then possible is to terminate the pregnancy, is the disease sufficiently disabling to warrant it? Perhaps the symptoms will not appear until middle age It is possible, now, to present a pregnant woman with such choices. Western society, and ultimately the whole human race, will also need to make such decisions. The smallpox virus was controlled and eradicated by immunisation; cystic fibrosis can be eradicated only by genetic controls and gene therapy. If this appears an attractive aim, let us consider that a copy of the cystic fibrosis 'gene' is a part of the genetic endowment of about 6% of all human beings. It is estimated that every human genome contains about 6 recessive lethal mutations in addition to those defective genes causing recognised diseases. None of us is immune to the implications of genetic medicine. Clearly there must be a point at which mankind says NO to diagnostic technology.

If genetic engineering were able to take us no further than the 'search and destroy' stage, a logical conclusion to the story would be a society with defined genetic norms monitored by technological screening programmes and with increasing pressure in favour of therapeutic abortion. Such a system, in which an individual's value and rights are determined by his genetic status, has been advocated even

recently by some prominent scientists. But there is an increasing demand for positive measures to improve the genetic quality of individuals and of the human gene pool. Already for many people, 'quality of life', in a biological sense, has overtaken in importance the post-war obsession with 'standard of living'. In particular, childlessness is now seen as a disease, to be treated like any other, and the perceived right of every woman to have not just children, but normal children, and if possible by any means, exceptionally gifted children, provides perhaps the strongest impetus for human embryo research. Thus the demand for available technology to be freely available comes not only from the doctors, but from their patients, and a subtle form of eugenics could emerge as increasing numbers of people see themselves as potential patients for genetic medicine, and indeed as clients or the gene merchants. While fertile, genetically normal women in certain sections of society are clamouring to pay handsomely to be inseminated by the sperm of the intelligent, the talented and the famous, abortion of the genetically abnormal foetus is justified in terms of cost-saving for society, and in terms of the alleviation of suffering for the aborted individual.

If *Homo sapiens* were no more than the most rational and successful species yet evolved on this planet, these arguments would be powerful ones. If modern medicine is responsible, as it is, for the maintenance and spread of deleterious genes in at least the populations of the developed countries, any opportunity to reduce that genetic burden should surely be welcomed, as one hope of ensuring man's otherwise dubious survival as a successful species. The fulfilment of individual desires becomes also a means of improving and purifying the human gene pool.

If, on the other hand, man is created in God's image, every individual having a unique value and dignity before the Creator, and a soul with an eternal destiny, such an evolutionist view of human life is both inhuman and blasphemous. Individual human lives may not be offered as sacrifices to the god of genetic purity, neither may the value of a person be judged, or his rights determined, in such terms. At the same time it is also true that the image of God in man is spoiled, and that the human genome has lost the perfection with which it was created.¹ The healing of genetic disease in the individual may be as legitimate and God-honouring as any other measure taken to alleviate human suffering.

Gene Therapy

Genetic engineering *would* take us further. We have established that it is possible to define the genetic defects responsible for particular disorders and to identify individuals who carry the defective genes. In 1985, about ten years after the first cloning of an entire gene, we have enough confidence in the methodology to be able to legally recommend abortion of a foetus on the basis of such a diagnosis. In

a further ten years we may possess the ability not only to identify a defective gene, but also to replace it with a normal, functioning copy. The technical problems are formidable and much more basic research is required as well as the technical development, but the possibilities have already been hinted at in this paper. Transgenic mice, genetically engineered by scientists, are alive and well in many laboratories. Transgenic livestock and cereal crops hold the promise of better food production in the future. Transgenic humans hold out the hope of treatment for many intractable diseases, and of the treatment, rather than destruction, of foetuses carrying debilitating genetic disorders or, to be more accurate, of embryos with defective genes. There is enormous potential in gene therapy, which could secure resources for its development for many years. Even the undoubted fact that treatment will for a long time be available only to the fortunate few, and at great financial cost, will be no obstacle, as we have seen in the case of organ transplantation.

The principle of gene replacement therapy is quite simple: to introduce into all the body's cells, or perhaps a subset of them, a normal copy of a gene which in the patient has been found to be defective either in its protein product or in its regulation. It may eventually be possible to cure certain inherited immune deficiency and blood disorders in this way, in the adult or the infant after birth. The therapy would involve removal of the patient's bone marrow, the transfer into the bone marrow cells of the appropriate gene(s) and reintroduction of the cells into the patient. Because the bone marrow contains the progenitor cells, or stem cells, for all types of blood cells, the genetically modified, or 'transformed' stem cells would repopulate the bloodstream with cells carrying the normal gene and its products. The surgical aspects of the treatment are already successfully used in the treatment of leukemia, in the form of bone marrow transplantation combined with lethal levels of radiotherapy. Gene therapy has the advantage of using the patient's own cells, eliminating the need for a donor and the possibility of rejection of the transplanted tissue. Healthy cells from a healthy individual could even be stored before the onset of disease, for use if and when the 'patient' should develop leukemia. The transformation of the cells, for instance by a normal haemoglobin gene, is currently possible, but this is the step at which further research is required. It is a routine research procedure to introduce any cloned gene or DNA fragment into cultured human cells, and to obtain expression of the gene product, but currently it is only possible to achieve insertion, or integration, of the DNA into the chromosomes of the transformed cell in a random manner. Gene therapy requires that the DNA inserts at a specific position, where its expression will be controlled in the correct way by regulatory signals such as hormones. Introduction of, for instance, the factor VIII gene to cure haemophilia, would perhaps prevent the patient from bleeding to death, but its uncontrolled expression would lead to problems from precisely the opposite cause.

The solution to this enormously complex problem lies in a fuller understanding of gene regulation, and of the ways in which DNA sequences are moved about within the mammalian genome. The need is to develop a vector which will deliver the gene to an appropriate position in a human chromosome. Vectors can be designed and engineered, but what appears difficult at present is the identification of suitable sites at which to aim them. The expectation that both these requirements will eventually be met is encouraged by the fact that gene regulation and mobile DNA elements, particularly the retroviruses (tumour viruses), are also vital areas of cancer research, and consequently attract major research programmes and funding.

The type of somatic gene therapy described above, although it has potential in many areas of medicine, is still only a halfway house in that the original genetic defect is still present in the germline — eggs and/or sperm — of the affected individual, and will be inherited in the normal Mendelian way. The aim of gene therapy in the embryo or fertilised egg is to introduce a normal copy of the defective gene in such a way that it will be present in all cells of the mature individual, expressed in the correct tissues at the correct levels, and inherited by his or her descendants. This requires that a single copy of the gene be integrated into the genome of the fertilised egg, or each cell of the early embryo, in a site at which it will be correctly regulated and stably inherited. The many experiments carried out on mouse embryos to date indicate clearly that these requirements can be fully met, but not in a predictable or reproducible way. In animal experiments, it is feasible to carry out an experiment on several embryos, and select for further studies those progeny on which the gene transfer was successful, while others are simply rejected. This is also an acceptable means of producing transgenic farm animals; there is no ethical objection to producing or killing defective experimental animals provided that no suffering is involved. Human experiments of this type clearly are unethical. However, a great deal of the knowledge gained from such animal experiments is of value in the approach to human embryo gene therapy.

Animal Experiments

There are two techniques which have been used successfully to introduce cloned genes into mouse embryos.³ The first, microinjection, has long been used to introduce different experimental substances into mammalian eggs and embryos. Despite the small size of the mammalian egg, it is large by comparison with a somatic cell, such as a blood or liver cell, and the method of injection, although at a microscopic level, is relatively straightforward. The DNA containing the required gene, normally cloned in a bacterial vector, is injected directly through the membrane of the egg using a very fine drawn glass needle. The resulting wound heals rapidly and completely. Because immediately after fertilisation the egg has no membrane-bound nucleus, it is necessary only to aim at the pronucleus, the

region of the egg which contains the nucleoplasm, where the egg and sperm chromosomes are located. The typical result of a successful injection is the integration of many tandemly repeated copies, maybe a few hundred, of the injected DNA at one or more apparently random sites in the egg chromosomes. After implantation of the transfected egg in the uterus of a surrogate mouse mother, these copies of the gene are faithfully replicated as the egg divides and develops, into every cell of the full grown mouse.

Recent developments in laser technology may allow the refinement of this technique, by using laser microsurgery to punch a tiny transient hole in the wall of the egg, through which DNA from the surrounding medium can enter the cell before healing of the wound within a few milliseconds. This method, if successful, would be less physically damaging and therefore safer, but the net result on the egg would be identical to that of microinjection.

The second method relies on the cloning of the desired gene into a mammalian vector, typically a retrovirus. These viruses contain DNA sequences which allow them to integrate into and to be excised from specific sites in the mammalian host cell DNA, and mammalian genomes already contain a vast amount of DNA which has been introduced from other organisms, or moved about within the genome itself, by such viral 'vectors'. Infection of the fertilised egg or embryo by a retrovirus vector introduces a single copy (or a few at most) of the cloned gene, which then integrates at one of several possible sites in the egg chromosomes. Normally only a single copy is integrated, and the integration site is somewhat specific, although many sites are possible. This is preferable to the result of microinjecting DNA, but the retrovirus route has the disadvantage that either infection or integration of the viral DNA may be delayed, resulting perhaps in a chimaeric embryo in which only a fraction of the cells contain the required inserted gene. The effect on the resulting fully grown mouse is unpredictable, and the inheritance of the inserted gene is non-Mendelian: the next generation progeny includes individuals which are fully transgenic, but the majority completely lack the new gene. In the case of animal experiments, such a situation is again manageable, as the F_1 progeny with the gene correctly inserted can be bred to propagate the new genotype. The ideal route probably requires a combination of the two approaches of microinjection and transfection, such that every cell of the embryo contains a single copy of the desired gene and its regulatory elements, integrated into a defined site in the genome.

The main conclusions of the transgenic mouse experiments may be summarised as follows:^{3,5}

Of the fertilised eggs or embryos transformed by either microinjection or retroviruses, between 10% and 50% grow to term after reimplantation. This probably reflects the difficulty of the surgical techniques and the normal frequency

of miscarriage as much as the effects of the transformation of the cells. However, of those fetuses which do survive, only about 25% are transgenic and express the inserted genes. Most integrated genes are expressed, but at varying levels and with variable effects on the physiology of the mouse. However, the regulation of expression of the inserted genes has been found to depend on the regulatory sequences inserted with the genes themselves, rather than on the integration site, which means that tissue-specific expression is normally achieved; immunoglobulins are expressed in B lymphocytes, rat elastase in the appropriate pancreatic cells in the mouse, etc. Thus introduction of the appropriate MHC gene into immunodeficient mice has been shown to cure the immune deficiency in a very specific, and inheritable, fashion.⁵ The 'little' mutation in mice, although of unknown aetiology, has been corrected by introducing the growth hormone gene into embryos. It is not because of the therapeutic potential, but as a research tool that these experiments are valuable, because they allow the study of the expression of genes in different tissues, and yield much information on the regulation of gene expression and its tissue-specificity. At the therapeutic level there have been successes in curing specific genetic defects, but there are troublesome side-effects, which include impaired fertility and abnormal growth control. Some of these harmful effects are certainly the result of insertional mutagenesis, which means simply that when the transferred DNA integrates into the genome, it sometimes inserts within an essential gene, destroying or impairing its function. 10-20% of transgenic mice probably result in such lethal mutations of essential genes, and there is no way of avoiding this without gaining control of the specificity of integration sites. Ironically, such mechanisms are themselves a major cause of the genetic defects of mice and men that we would wish to cure, performing spontaneously in nature the types of transformation that genetic engineers seek to control in the test tube.

The results obtained from transgenic mice demonstrate that both the methodological biological aspects of gene therapy are feasible, although both require considerable refinement. Similar experiments performed on larger animals, such as rabbits, sheep and pigs,⁶ have proved to be more difficult, but the prospects for inserting new genes into farm animals, at least in the long term, appear good. Moreover, each single successful gene transfer in animals can be propagated by breeding while failures can be rejected. The aims of human gene therapy are different, and the procedures can be justified only if there is a high probability of successfully treating every human embryo brought into being. This requirement cannot yet be met in mice, and the prognosis for eliminating the uncertainty is itself uncertain. At this stage, therefore, to perform any such experiments on human eggs or embryos would be purely in the realm of experimentation, and in any case the type of data that are currently required can be gained from animal experiments. There can be no justification for the 'creation' of human embryos, nor for the use of 'spare' IVF embryos, for such purposes into the foreseeable future. How far can we see into the future of embryo gene therapy?

Response

How are we to formulate an appropriate Christian response to these achievements and their prospects? The discussion so far of the scientific issues has perhaps focussed on the potential benefits of gene therapy, but of course all this technology is open to abuse. Even if gene therapy were to become feasible as a medical procedure without violating any ethical standards, there would still be legitimate debate over the question of which genes might be considered inviolable. The extent to which genetic characteristics contribute to those aspects of humanness which constitute the image of God in man, is largely imponderable. In any case to look at the prospects for the improvement of intelligence or temperament by gene therapy is hopelessly in the realm of speculation. Although no genetic engineer is seriously attempting to clone the gene(s) for altruism or for aggression, it might nevertheless be unwise to discount the possibility of genetically engineering such qualities. For some who reject the Biblical view of man, such developments might seem to offer hope of improving the human condition, but we must be clear that sin and evil and the problem of fallen human nature are dealt with by the cross of Christ alone. We should not be led by the theological issues, however, into rejecting the medical benefits that might be achieved by gene therapy, especially remembering that in the past Christian scientists and doctors have been responsible for major advances in medicine and the alleviation of suffering. In His earthly ministry Christ never forgave the sinner without also healing the body.

Given the Biblical position that the conceptus, or fertilised egg, constitutes an inviolable human life, the difficulty is that the benefits to be gained from gene therapy are in conflict with the means of attaining them. Can it ever be right to sacrifice the life of even one human embryo in order that future embryos as yet unconceived might live and be healed of their genetic defects? The answer, surely, must be an unqualified NO. That principle must be stated clearly and defended unequivocally.

To leave our response at that point and to campaign against any form of research on human embryos may, however, be a reaction to the inevitable which is no less futile and inadequate than would be a campaign against the development of nuclear power. The progress of genetic engineering thus far has been a continuum, closely allied to many other fruitful areas of research. There is now no criterion by which we may draw the line and say, 'far enough'. We must recognise that 'spare' human embryos are already the subject of research, and though the research may be stopped, IVF will continue to generate embryos in the knowledge that some must die, as a by-product of the relief of infertility. The inevitable which we face is constituted by an increasing body of knowledge and the ability to do things, some of which are at worst ethically neutral and at best will lead to cures for

cancer and other intractable diseases. Transgenic farm animals will certainly be a reality within five years, despite inevitable campaigns by the animal rightists once the news leaks out. The pattern of development of revolutionary techniques in medicine, from drug development to organ transplants, has been to establish the methods in animal models, and then to proceed to 'clinical trial', which has often been almost synonymous with human experimentation. At what point does the development of gene therapy in animals reach a stage from which to begin human gene therapy might legitimately be viewed as 'clinical trial'. At that point, the one clear ethical issue we might raise is that of consent, but even that argument is equivocal: can the newborn spina bifida baby give consent for corrective surgery which has less than 100% probability of success? Is treatment then denied? If the embryo is to be afforded the same rights as the newborn, should not equal opportunity also be given?

The Biblical view of human life is a continuum which starts in the knowledge of God even before conception, within or without the womb. It is on these grounds that we would argue that the human embryo is an actual human individual and thus — rightly — oppose embryo experimentation. Might we wish to extend the rights of that embryo to include the right to all available treatment for known diseases, especially if the embryo is the only stage at which treatment is possible? Thus might we argue, that if Duchenne muscular dystrophy were diagnosable at the pre-implantation stage of life, which it very nearly is,⁷ and if gene therapy were available, which it conceivably will be, we would be morally obliged both to diagnose and to treat the disease, and thus transform a life destined to be short and painful into one which would be 'normal'? We may wish to discuss whether the genetic defect in itself, which in the embryo is asymptomatic, actually constitutes a disease — death might intervene before symptoms appear — but the answer to the question, in principle, is probably YES. Prophylaxis is always more effective than treatment.

Space does not allow any more detailed discussion of the ethical issues. The questions which have been touched upon are those which relate directly to the application of genetic engineering, but these must be considered along with the wider issues of embryo research, on which others have written and spoken at much greater length.^{9,10} This paper would, however, be incomplete without some attempt to put gene therapy within the wider context of embryo research. The end point of the process has been looked at in some detail, but there are steps along the way which require an ethical response, and which should indeed be constrained by ethical considerations. Throughout this discussion has been the implicit acceptance of *in vitro* fertilisation (IVF) — an established procedure which in itself raises difficult ethical problems, but which is probably accepted by most Christians as a legitimate means of overcoming infertility. It is IVF which opens the

way to the application of any genetic engineering techniques and to many areas of research which must be opposed on moral grounds. We need to take care lest our moral judgement be clouded by our compassion for the childless, which might be better expressed in other ways than handing over the problem to technology.

The Future

It is difficult to know just what research projects are under way or being contemplated. The lack of any published response to the Appeal in March 1985 from the Editor of the Journal Nature,⁸ for the submission of proposed research projects on human embryos, is indicative of the reluctance of the scientific community to be too open in this area. The following are offered, without ethical judgement, as being possible research fields in which human embryos may already be used, in the future, if not already:

- (1) Studies of normal and abnormal development, perhaps including the effects of teratogenic substances, viral infection, etc. Valuable information could be gained on the causes and prevention of congenital defects, spontaneous abortion and other foetal damage, but embryos would need to be studied over several weeks of development. For example, the nervous system begins to develop at day 17, and major organs even later. A 14 day limit would severely restrict such work.
- (2) Development of culture media to support prolonged embryonic growth and development *in vitro*. The main purpose would be to improve IVF, facilitate gene therapy techniques, and extend the scope of (1). Ectogenesis (complete development outside the womb) is probably not a realistic aim. The low 'efficiency' of IVF is blamed partly on inadequate culture conditions, and this work would be seen as a priority.
- (3) Dissection of embryos for chromosome analysis to search for defects, and culture of embryonic cells to provide quantities of DNA suitable for genetic analysis using recombinant DNA probes.
- (4) Culture of embryonic and foetal cells in the hope of growing tissue culture cells for use as transplant tissues. It is already known that mouse embryos from which few cells have been removed will continue to develop normally, while the dissected cells can be cultured readily. This raises the possibility of embryos as transplant donors (and views embryo dissection as a form of biopsy).
- (5) Microinjection and retrovirus transfection to transform embryonic cells. Such research would be an essential prelude to gene therapy, although it may be possible to reach a point where data from animal embryos and cultured human somatic cells would be able to predict the results of transfection of human embryos, with some confidence.

- (6) Development and testing of contraceptives.
- (7) Human cloning. Identical twins come close to being human clones (groups of individuals with total genetic identity). This is because each gains a copy of the genetic complement of the same fertilised egg after completion of the processes of recombination, which reassort the genes of the parents and cause individual eggs and sperm to differ from one another in genotype. Frogs can be cloned by injecting the nuclei (which contain the chromosomes) of somatic or embryonic cells, which are identical one to another, into eggs from which the egg nucleus has been removed. The eggs then develop into frogs with identical copies of the genome derived from the somatic cells. The cloning of humans, though very much more difficult, probably requires only refinements of the frog cloning technique. Each clone would require a surrogate mother, but would not be the product of the union of egg and sperm.

There is one further technique which will be important in the development of human embryology. The ability to freeze embryos and store them for long periods makes it possible for diagnoses to be carried out and decisions to be made on possible therapy, while the growth of the embryo is arrested by controlled freezing in liquid nitrogen. This enables embryos, as well as sperm, for which the procedure is routine, to be stored for periods of years, and has prompted speculation as to the feasibility of long-term preservation of individual people in the form of their genomes. This has many science fictional applications, but note the importance of freezing in the following suggested protocol for the production of a genetically perfect baby. This method could be applied to allow parents with genetic defects to bear children without the defect. It must be stressed that it will not be feasible for many years yet, if ever, but we may have to face the prospect sooner than we think.

Miracle?

- (1) Select parents on basis of known genetic characteristics.
- (2) IVF — generate several embryos.
- (3) Culture embryos to pre-implantation stage.
- (4) Sample a few cells from each embryo (biopsy?)
- (5) Freeze embryos and await results of genetic screening.
- (6) Culture biopsy cells, examine chromosomes; extract DNA and screen for defective genes using recombinant DNA probes.
- (7) Thus identify embryos without any detectable genetic abnormalities; thaw these out and implant into mother's uterus.
- (8) If gene therapy is indicated, treat as appropriate. It may be necessary to go back to the fertilised egg stage and start again.
- (9) Monitor pregnancy, deliver with care.

Monster?

or

Miracle?

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This list is brief, partly because much of the material discussed has not been adequately reviewed in this context, partly because much of it is very recent, and the details are to be found only in specialised scientific journals. It is hoped that the following list will enable the interested reader to pursue the discussion further.

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DOCTORS AND WARNOCK

Pamela F. Sims,

The Warnock Report,¹ published last year, arose in response to the rapid advances being made in the field of *in-vitro* fertilization (IVF) and embryo transfer (ET), popularly known as ‘test tube baby’ research. As often happens in areas of scientific work, the technology is tried and tested rather quietly until a successful case (Louise Brown in July 1978) is suddenly given huge publicity, and the intricacies of the underlying mechanisms are thoroughly rehearsed in the media. Suddenly everyone is talking about these wonderful new techniques and medical centres up and down the land (and around the world) are wondering how to implement them. Countless hundreds of infertile couples must have thought (and still do) that this new method will be the answer for them, and are clamouring for it paying scant heed to the implications, moral or otherwise.

On the face of it IVF has been largely promulgated with the alleviation of infertility as its chief end, though it must be recognised that from the early days of research in the late 60’s, Dr. R. G. Edwards was quite open about his other aims. There was the development of knowledge of contraceptive means and also the furtherance of our understanding of certain genetic disorders.² At the outset of our consideration of ‘Doctors’ and their response to, or their involvement with whatever issue, we must appreciate that under that umbrella title there is a host of different breeds! At one end of the spectrum is the family general practitioner faced with a couple whom he may have known for years — then at the other there is the pure scientist working in his laboratory; he may or may not be medically qualified, but he will certainly be a very clever chap with higher qualifications after his degree and a string of publications to his name! Somewhere in the middle is the gynaecologist who may or may not have a special interest in infertility. Then there are also geneticists, haematologists, paediatricians, cancer specialists and so on — all with a stake in Warnock.

Essentially there are probably two basic types of doctor. One is the clinician, concerned primarily with the welfare of the patient — he practises the ‘art’ of medicine, realising that human beings are not merely machines, albeit complex ones. Treatment of the whole person involves another dimension, a non-physical one comprising emotional and spiritual factors. The true scientist (and he may be a medical doctor) on the other hand is engaged in the pursuit of knowledge. Research for its *own sake*. The advance of medicine has always depended on both types of doctor and both types have been drawn into ‘Warnock’.

Whilst the conclusions of the Warnock Committee may have far-reaching implications for different branches of medicine, at the end of the day it is the gynaecologist who is often involved in the *execution* of the techniques involved. This is not the first time that ‘treatment’ having moral implications has been thrust into the hands of gynaecologists. We do not have to look far into history to remember abortion and the introduction of artificial insemination.

Just as there are many specialties involved in Warnock so there are many motives represented within the specialties, including gynaecology. There are genuine altruistic ideals, whether directed at the treatment of the infertile couple or the advancement of scientific knowledge, but there is also ambition for fame and acclaim, and perhaps sheer avarice on the part of some. The Ethics Committee of the Royal College of Obstetricians and Gynaecologists reported on IVF³ and presumably felt that it was representing the views of gynaecologists as a whole — in the final analysis, however, these were the opinions of the eight members of the Committee. Maybe they were shared by the majority of gynaecologists in the country — maybe they were not. But when all is said and done, every one of us is influenced, whether consciously or subconsciously, by our own beliefs. Sadly, the distinctly Christian influence seems to have disappeared from the machinations of these Committees, be they Warnock or of the RCOG. Cold utilitarianism or perhaps humanism is the order of the day.

The Infertility Scene

It is generally believed that around one couple in ten is infertile — in America the figure is supposedly more like one in six. The causes are numerous, some relatively easily treated, others not at all. Male infertility probably accounts for around a third of the cases. Most of the Warnock Report is taken up with artificial means of overcoming disorders not amenable to conventional drug or surgical treatment. The intrinsic problem is not treated — the woman, or man is as infertile at the end of the day as she or he was at the beginning — it is circumvented.

The Warnock Report draws attention to the variable and sometimes inadequate facilities available to the woman unable to conceive. Traditionally these women, after referral from their general practitioner are investigated by a gynaecologist. Whilst it is true to say that the RCOG is now keen on ‘sub-specialisation’,⁴ whereby gynaecologists with an interest in the field which includes infertility could concentrate on this (or other broad areas) and become ‘super-specialists’, the fact remains that the overwhelming majority of gynaecologists at the present time are ‘generalists’, doing ‘everything’, with perhaps a special interest here and there. The average gynaecological outpatient department does not make any special

provision for the woman with a fertility problem, though it must be said that a proportion of these couples may turn out to have a relatively easily diagnosed problem. A further proportion will get pregnant whether or not doctors do anything at all! The almost deliberate delaying tactics displayed by some gynaecologists in the management of infertility are simply a recognition of this fact.

Unfortunately, there remains a hard core of men and women who are not going to respond to the conventional methods of treatment available. Drugs can sometimes successfully restore the normal balance of hormones and in other cases an operation will unblock fallopian tubes which for one reason or another are obstructed. The Warnock Report is largely concerned with the artificial means of overcoming these sorts of defects. Technology is developing by leaps and bounds and may not be uniformly provided within the NHS.

In the first place we need to address ourselves to the overall question of the rightness of treating infertility. Obviously in some cases the man or woman is infertile because of a disease process which must be treated like any other disease. However, there are other individuals in whom no abnormality can be found on investigation, yet others have been voluntarily sterilised (understanding the irreversibility of the procedure). Do they have an absolute right to reproduce? Warnock refers to the European Convention on Human Rights which seems to feel that probably we all do! In western medicine the emphasis has partially switched from the curing of life-threatening diseases to the positive promotion of well-being — physical and emotional — which would include the ability to have children.

The Warnock Report does touch upon the realities of treating infertility (p.33, 34) when it spells out the results of treatment in Bourn Hall (the largest centre in this country for IVF). The fact is, not only are the results of IVF rather disappointing at the present time (less than a quarter of those having the treatment actually end up with a babe-in-arms at the end of the day) the results of infertility treatment as a whole are not brilliant. Gynaecologists all too often encounter the woman who has become obsessed with the desire to have a child. Her marriage is suffering, her friends and relatives have long since become bored with the sole topic of conversation and the woman herself becomes totally stunted as a person. There comes a point in time where she *has* to come to terms with her childlessness. After all, we *all* have to come to terms with certain things in our lives. As Christians we can more readily understand this within the providence of God. The problem is that we live in a consumer-orientated age here in the West — to a degree we are wrapped in cotton wool, we have been conditioned to expect everything on a plate. Babies “to order” — and normal ones at that — alternatively, removal of a pregnancy (to order) should it be inconvenient. The concept of each new life

being a gift from God has almost become laughable in the medical profession, and this attitude affects at its very roots current thinking (such as there is) on embryo research, certain forms of contraception and abortion.

Artificial Insemination

Much of the Warnock Report is taken up with description, in clear terms, of the medical techniques in vogue for the alleviation of infertility. The methods are 'artificial' in that the desired pregnancy is not achieved by normal intercourse, it requires the intervention of (usually) the doctor to allow the sperm to reach the egg. AIH utilizes the husband's sperm and AID an anonymous donor's. The second procedure introduces a third person into the marriage relationship whereas the first does not, and in that sense is more akin to IVF when the couple donate their own gametes (egg and sperm).

Christians on the whole seem to have no qualms about AIH. A fairly recent article in 'Today' magazine⁵ says "Using the husband's semen in the insemination process is quite obviously a good use of the medical technique with few, if any, moral problems . . .". AIH is thus dismissed in one brief sentence, the remainder of the article being taken up with AID. But wait a minute. Our Roman Catholic brethren would emphasise the mystical element of sexual union between a man and his wife, and maybe some more thinking along this line would be relevant to our entire discussion. Furthermore, though AIH might be acceptable to most, we have not had to wait long before seeing it abused. It is now accepted practice to freeze and store sperm of a man about to undergo medical or surgical treatment which could render him sterile, with the idea of using it later, if necessary. A natural extension of this mentality is the request for insemination after the death of the husband. Such cases have been reported during recent months.

Artificial insemination by donor is far more controversial. The Church of England's initial reaction was that it was wrong; now the practice of AID has gained general acceptance and the Church is silent on the matter. Most of the submissions to the Warnock Committee were in favour of the technique, and the Report, having summarised the pros and cons and assuming that AID must be freely available, simply tries to tidy up the loose ends which exist within the law. For instance, there is the recommendation that AID children should be treated in law as the legitimate offspring of the woman and her (infertile) husband, which of course is totally dishonest. The other recommendations in similar fashion are of social and legal significance, rather than medical — so will not be further discussed here. Suffice it to say, that as in the wake of the Abortion Act, doctors are expected

to go along with what is officially legal. Doctors are increasingly being expected to perform as technicians, carrying out the requests (demands?) of their patients. Warnock does, however, recognise that there will be instances where “consultants decline to provide treatment . . .” (p.12) but nevertheless we must give a “full explanation of the reasons”.

In Vitro Fertilisation

When people think of the Warnock Report they tend to think of ‘test tube babies’ or IVF. We have thus far reminded ourselves that the Report in fact spread its net more widely and includes other artificial methods of ‘baby-making’. Now we shall look more closely at the more recently developed techniques.

As a ‘treatment’ for infertility IVF finds its particular application in the case of the woman with blocked fallopian tubes. The idea is simple. The blockage which prevents the egg passing naturally from the ovary, where it is produced, to the womb’s cavity, where, if fertilisation occurs, it may develop into a baby, is by-passed. This is done by removing the egg by aspiration through a fine needle (ovum retrieval), fertilising it with sperm (husband’s or donor’s) and replacement of the embryo thus produced back to the woman’s womb (ER embryo replacement or ET embryo transfer).

So far so good. Maybe in theory most Christians would find the idea of an egg and sperm from a particular couple undergoing treatment for infertility, with the express aim of producing a much wanted child into a loving environment, quite acceptable — indeed to be encouraged. The problems arise when the practicalities are considered. At the present time the eggs are usually removed laparoscopically, i.e. an operation, with full general anaesthesia, is performed. A laparoscope is a kind of telescope allowing direct visualisation of the pelvic organs, including the ovaries and their follicles (tiny cysts containing the egg cell). It is a procedure not without risk and in an attempt to reduce the number of laparoscopies per woman the problem of embryo ‘spares’ has come about.

Under normal conditions one or two eggs each month are produced, drugs have been developed which enhance this mechanism and as many as 10 or 12 have been retrieved at one sitting. This means that they can all be fertilised, and perhaps 3 or 4 replaced. It is recognised that less than the number of embryos replaced will actually ‘take’ so it is a fine balance between achieving an on-going pregnancy and avoiding one of high multiple, where none may survive because of all the complications associated with such pregnancies and births.

We now have two problems. The first is that given a number of successful fertilisations there is a rather sinister *selection* of the embryos that seem to be the healthiest, to replace. Secondly, we have produced *more embryos than needed* for one pregnancy. Those not required for the first attempt at pregnancy (in vitro) can now be stored in deep freeze, then thawed out for future attempts at pregnancy. Alternatively, eggs/embryos may be donated to other women or the embryos could be used for research.

“Spare” Embryos

Firstly one wonders if the over-production of eggs, hence embryos, has been more than simply fortuitous — that all along ‘other’ uses for the embryo might have justified induction of super-ovulation all too conveniently.

Warnock tries to reassure us with such recommendations as a 10 year maximum for the storage of embryos and thinks that a licensing body for embryos (and sperm) will somehow make what we are doing morally right. The matter of how we treat these spare embryos has caused more public debate than any other point raised in the Report, and indeed resulted in three of the members of the Warnock Committee making a dissent (p.90). We should be encouraged by this, for the central issue of this debate finally emerges. When does life begin — that is, individual human life? The biologist will provide a fuller answer than the medic, however, we can remind ourselves here that modern science only echoes the testimony of scripture and the teaching of the Church through the ages i.e. conception. The 14-day limit on embryo research now becomes irrelevant. (The derivation of this particular timing will presumably be dealt with elsewhere.)

The word ‘research’ is rather vague — what does it mean? A distinction is sometimes made between observation and rather more active intervention. Certainly it is true to say that no IVF baby would ever have been born in the first place without ‘research’. The chemical make-up of the nutrient fluids for egg/sperm/embryo had to be modified until the optimal ones were found. During this time the fate of these germ cells was ‘observed’. Long before any embryo was transferred back to the mother, fertilised eggs and early embryos were scrutinised under microscope, living and dead, at various stages of early cell division.

Intervention may involve removal of a cell of the embryo at an early stage which may not cause any ill effect, this one cell contains all the genetic information that dictates the characteristics of this new individual. At a fairly basic level the chromosomes can be counted and the embryo sexed, at a much more sophisticated level gene-probes are being developed which can detect all manner of genetic abnormality. Genetic ‘engineering’ sounds futuristic but the reality is just around the corner.

Most doctors involved with the treatment of children and adults suffering from diseases with a genetic basis would whole-heartedly encourage such work. And indeed, our aim is to cure the patient, why should genetic ‘surgery’ be seen in a different light from any other? The problem at the moment is that abnormality generally equals annihilation.

In the public eye research is more typically the testing of drugs and even cosmetics. We have grown used to the idea of using animals in such a manner and Warnock thinks that similar controls may be applied to embryos as animals. The Report admits that ‘human material’ is somehow different from animal but goes no further. In fact when testing of drugs etc. is carried out on humans it is with their ‘informed consent’. This is not possible with children nor embryos. When babies are subjected to such new and experimental procedures as heart transplants, it is in cases where the alternative would be certain death in any event.

The thread of utilitarianism runs through the entire Warnock Report — i.e. it allows whatever brings the greatest happiness to the greatest number of people. Without too much prompting we can imagine batteries of embryos being harvested for the drug industry, genetic engineering, cancer research, for the development of tissue for organ replacement and so on. The general public and patients in particular will be easily swayed by emotive subjects like ‘cancer’ and the views of those who have had offspring affected by genetic disorders will naturally be coloured: the desire is to stamp out these diseases but perhaps without serious consideration of the cost. For the cost does not stop with the lives of the embryos sacrificed but must include the eventual effect on the nation’s morality. We have seen how the Abortion Act has gradually eroded our conscience and cheapened life at other stages. Incredibly light sentences seem to be passed on those convicted of infanticide and euthanasia (of the elderly or the young incurable), meanwhile instances of baby battering and muggings continue to rise in society. Is it too much to suggest a link in all these evils, and that Warnock in many ways serves to compound them?

The use of embryonic ‘material’ is not the *only* way ahead for cancer and genetic research, it is not *essential* for drug testing. Surely God would honour our stand in not using methods so suspect, in the light of Christian teaching, perhaps by allowing some fantastic step forward in research using conventional techniques! When all is said and done we have to remind ourselves that it is only a matter of four decades since Hitler’s Germany and how deeply culpable were doctors in the implementation of his eugenic programmes.

Before we deal with Surrogacy, the last main topic, we should recap on the various possibilities available using modern technology, and mostly endorsed by the Warnock Report. We shall use the terms ‘husband’ and ‘wife’, though it is acknowledged that the infertile couple (or ‘commissioning couple’) may not be married.

1. Wife plus Husband by Artificial Insemination by Husband (AIH)
2. Wife plus Donor by Artificial Insemination by Donor (AID)
3. Wife plus Husband by In Vitro Fertilisation and Embryo Transfer (IVF and ET)
4. Wife plus Donor by In Vitro Fertilisation and Embryo Transfer
5. Donor (of egg) plus Husband with IVF and ET to Wife
6. Donor (of egg) plus Donor (of sperm) IVF and ET to Wife
7. Embryo naturally conceived obtained by lavage and transferred to Wife
8. Embryo conceived by AI with Husband’s sperm obtained by lavage and transferred to Wife

Embryo lavage is a procedure used for some time in the veterinary world. A normally developing embryo is washed out of the womb before it has had chance to implant and replaced in the infertile woman’s womb. Warnock does not like embryo lavage because of possible problems for the donor such as infection in the womb, and also that it might not work: the donor would then be faced with an unwanted pregnancy. Genetically, however, 7 above is identical to 6 and 8 to 5.

Surrogacy

Popularly known as ‘womb leasing’ this method involves the carriage of a pregnancy by a woman other than the wife of the infertile couple, with the intention of handing over the baby to the couple at birth. The Warnock Committee allows almost everything else in the book but it balks at surrogacy. Chiefly because of the large sums of money sometimes involved, furthermore, the emotional difficulties involved in parting with a newborn baby are considerably more than in egg/embryo donation. The question arises — Who is the mother? The genetic mother or the woman who bears the child? Our law does not cover this situation and for the present it is likely that the woman who carries the pregnancy would have the stronger case.

Surrogacy is not a new technique. Since Old Testament times infertile women have used other women (usually maids) by whom to bear offspring. Only insemination by artificial means brings it into the realms of modern technology. Surrogacy is popular in America where various agencies have sprung into being and would be popular here if legalised. One reason could be the far higher success rate of pregnancy in a woman of proven fertility. The sort of situations where a surrogate womb is necessary would include women with hopelessly diseased pelvic organs or those who have had a hysterectomy. Those cases where miscarriage is repeated, whether the reason is known or not, may feel a surrogate pregnancy is their only chance. Lastly, more sinisterly, some women simply may not fancy the personal inconvenience of a pregnancy and therefore require another woman to carry it for them.

Legal or not, some gynaecologists are convinced that surrogacy is acceptable (for instance between sisters or close friends) and certainly there are such on-going pregnancies in this country.

To complete the summary started above:-

9. Surrogate carries child conceived by AI with Husband's sperm plus own egg
10. Surrogate carries child conceived by IVF Husband's sperm plus Wife's egg
11. Surrogate carries child conceived by IVF Donor sperm plus Wife's egg
12. The last possibility is that a naturally conceived child (by surrogate's husband) is handed over to the infertile couple.

The comparison is always drawn between these artificial means of fertility, and adoption. It is said they are the same except the child may at least have half his genes derived from one parent or the other. But really they are altogether different. The child who is adopted has by accident been conceived — adoption is making the best of a situation which, whether we like it or not, *has happened*. In AID/IVF/embryo donation the child who is born comes about because *we make it happen*. In all the discussions surrounding Warnock the feelings of the children 'produced' seem to be considered far less than those of the infertile couple.

The Way Ahead

Whatever we think about the contents of the Warnock Report, and whatever legislation comes to pass, we can be sure that AID and IVF are here to stay. Is there any way that we could avoid the more controversial problems — particularly that of 'spare embryos'?

Low Ovum Transfer is a technique which avoids IVF altogether. The woman with blocked tubes undergoes laparoscopy and ovum retrieval as if for IVF but instead of leaving the eggs outside the woman's body for fertilisation, they are immediately transferred to the cavity of the womb. Stimulation of the ovaries to produce many eggs is not necessary. Intercourse must take place within a short time and fertilisation, if successful, occurs in the womb — naturally, and all being well, the embryo implants. There are no centres in the UK (to the author's knowledge) using this method and the pregnancy rates must be considerably lower than conventional IVF and ET.

Ultrasound Improvements in some units are such that they have been able to virtually abandon laparoscopy for the retrieval of eggs. Under ultrasound control with a simple local anaesthetic it is possible to pass a fine needle through the abdominal wall down to the egg follicle and aspirate the eggs. Theoretically this procedure could be repeated any number of times and there is no need for superovulation. Embryo replacement is a painless procedure requiring a straightforward internal examination.

Egg Freezing. If it were possible to freeze and store eggs, in the same way as sperm, all the ethical problems surrounding embryos would vanish overnight! In fact one can freeze eggs, but in the thawing out process they are much more likely to be damaged than embryos. (This is possibly due to the relatively large size of the single egg cell.) Technology is constantly advancing and egg freezing is bound to become feasible within the next few years.

Some would argue — but surely life is a continuum, why is freezing embryos so different from freezing sperm or eggs? The answer again is that individual human life is not a continuum. We have a biological and spiritual beginning on this earth. If we must single out one event which marks that beginning, the only one that is not arbitrary is fertilisation. An egg or a sperm will never develop into anything else, unless the one meets the other they will die — even in the most nutrient of media. On the other hand, an embryo, given the right environment and without any intervention, will develop into you and me.

In conclusion, we are at a crucial stage in the debate on the Warnock Report. For we are still in a position to influence fellow Christians, the public at large and even parliament, as we await legislation. The controversy which has been aroused simply will not lie down and die, yet all the while there is a growing acceptance of this new technology. Patients now walk into the gynaecological outpatients and actually ask for IVF having reached the 'end of the line' of routine investigation and treatment. Teaching hospital centres are all jumping on the bandwagon,

anxious to set up IVF programmes lest they be left behind in the race to be at the forefront of ‘Centres of Excellence’. The medical profession desperately needs prayer, that its corporate conscience might be pricked concerning these life and death issues and that there may be a return to the spirit of statements such as the Declaration of Geneva “I will maintain the utmost respect for human life from the time of conception”.⁶

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